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ABSTRACT

This is the student's edition of the Record Book for "Winds and Weather" of the Intermediate Science Curriculum Study (ISCS) for level III students (grade 9). Space is provided for answers to the questions from the text as well as for the optional excursions and the self evaluation. An introductory note to the student explains how to use the book. (SA)

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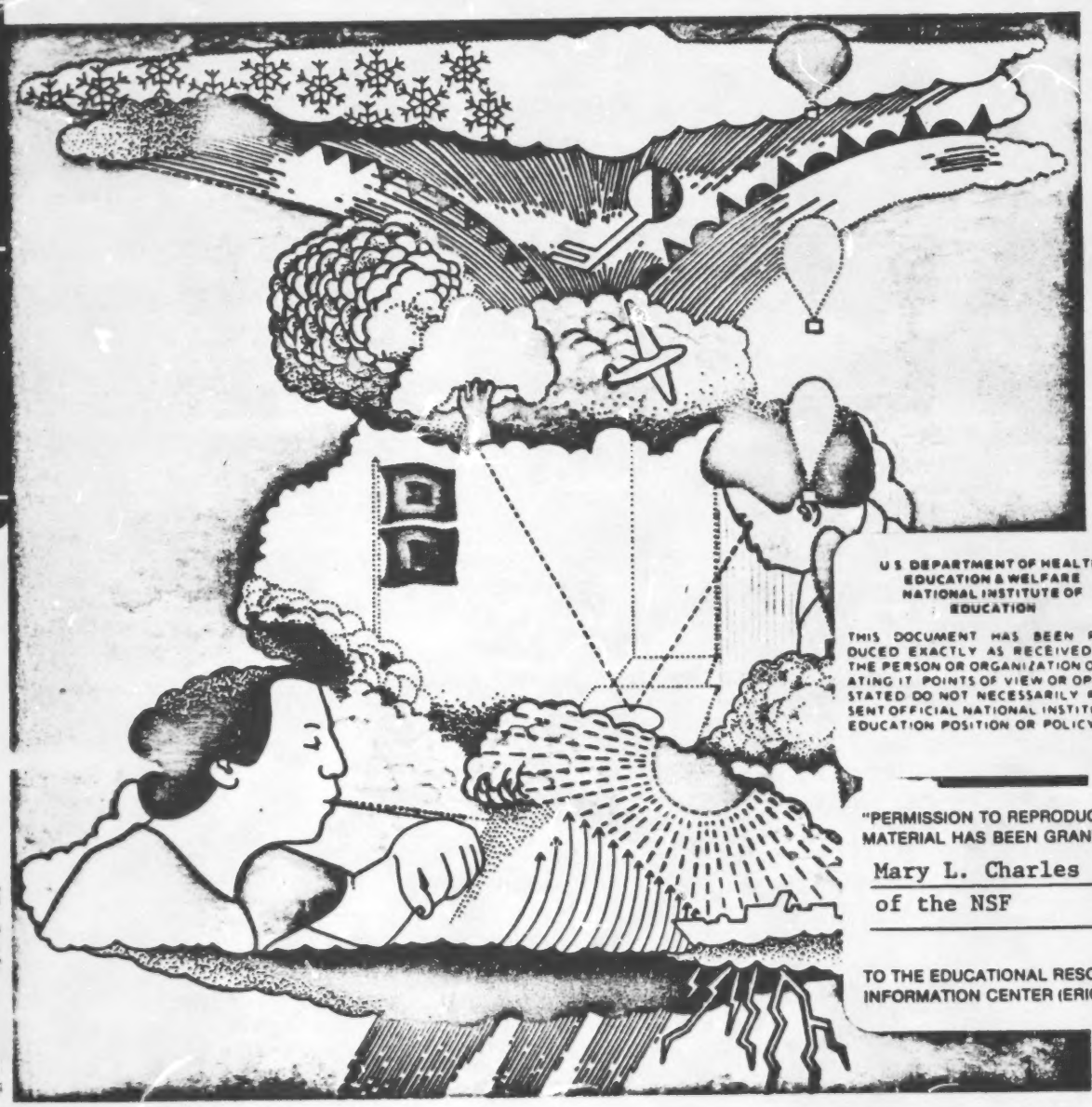
Winds and Weather



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Record Book

Winds and Weather

Probing the Natural World / Level III

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The genesis of some of the ISCS material stems from a summer writing conference in 1964. The participants were:

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Foreword

A pupil's experiences between the ages of 11 and 16 probably shape his ultimate view of science and of the natural world. During these years most youngsters become more adept at thinking conceptually. Since concepts are at the heart of science, this is the age at which most students first gain the ability to study science in a really organized way. Here, too, the commitment for or against science as an interest or a vocation is often made.

Paradoxically, the students at this critical age have been the ones least affected by the recent effort to produce new science instructional materials. Despite a number of commendable efforts to improve the situation, the middle years stand today as a comparatively weak link in science education between the rapidly changing elementary curriculum and the recently revitalized high school science courses. This volume and its accompanying materials represent one attempt to provide a sound approach to instruction for this relatively uncharted level.

At the outset the organizers of the ISCS Project decided that it would be shortsighted and unwise to try to fill the gap in middle school science education by simply writing another textbook. We chose instead to challenge some of the most firmly established concepts about how to teach and just what science material can and should be taught to adolescents. The ISCS staff have tended to mistrust what authorities believe about schools, teachers, children, and teaching until we have had the chance to test these assumptions in actual classrooms with real children. As conflicts have arisen, our policy has been to rely more upon what we saw happening in the schools than upon what authorities said could or would happen. It is largely because of this policy that the ISCS materials represent a substantial departure from the norm.

The primary difference between the ISCS program and more conventional approaches is the fact that it allows each student to travel

at his own pace, and it permits the scope and sequence of instruction to vary with his interests, abilities, and background. The ISCS writers have systematically tried to give the student more of a role in deciding what he should study next and how soon he should study it. When the materials are used as intended, the ISCS teacher serves more as a "task easer" than a "task master." It is his job to help the student answer the questions that arise from his own study rather than to try to anticipate and package what the student needs to know.

There is nothing radically new in the ISCS approach to instruction. Outstanding teachers from Socrates to Mark Hopkins have stressed the need to personalize education. ISCS has tried to do something more than pay lip service to this goal. ISCS' major contribution has been to design a system whereby an average teacher, operating under normal constraints, in an ordinary classroom with ordinary children, can indeed give maximum attention to each student's progress.

The development of the ISCS material has been a group effort from the outset. It began in 1962, when outstanding educators met to decide what might be done to improve middle-grade science teaching. The recommendations of these conferences were converted into a tentative plan for a set of instructional materials by a small group of Florida State University faculty members. Small-scale writing sessions conducted on the Florida State campus during 1964 and 1965 resulted in pilot curriculum materials that were tested in selected Florida schools during the 1965–66 school year. All this preliminary work was supported by funds generously provided by The Florida State University.

In June of 1966, financial support was provided by the United States Office of Education, and the preliminary effort was formalized into the ISCS Project. Later, the National Science Foundation made several additional grants in support of the ISCS effort.

The first draft of these materials was produced in 1968, during a summer writing conference. The conferees were scientists, science educators, and junior high school teachers drawn from all over the United States. The original materials have been revised three times prior to their publication in this volume. More than 150 writers have contributed to the materials, and more than 180,000 children, in 46 states, have been involved in their field testing.

We sincerely hope that the teachers and students who will use this material will find that the great amount of time, money, and effort that has gone into its development has been worthwhile.

Tallahassee, Florida
February 1972

The Directors
INTERMEDIATE SCIENCE CURRICULUM STUDY

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Notes to the Student

This Record Book is where you should write your answers. Try to fill in the answer to each question as you come to it. If the lines are not long enough for your answers, use the margin, too.

Fill in the blank tables with the data from your experiments. And use the grids to plot your graphs. Naturally, the answers depend on what has come before in the particular chapter or excursion. Do your reading in the textbook and use this book only for writing down your answers.

Chapter 1
Air Has Its Ups and Downs

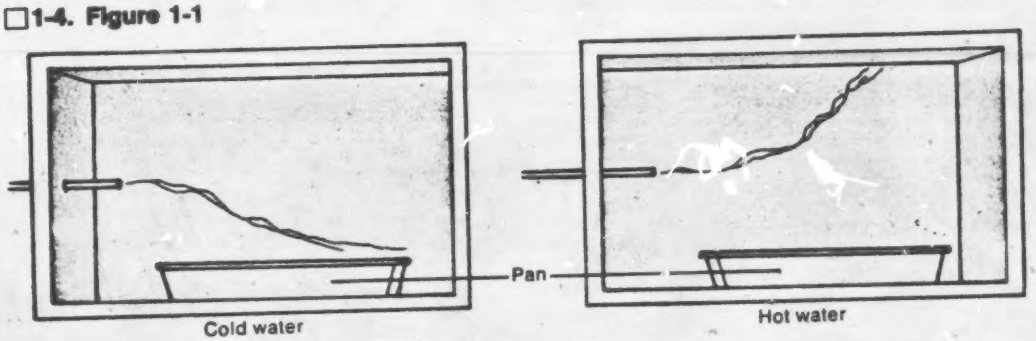
☐1-1. _____

☐1-2. _____

☐1-3. _____

_____

☐1-4. Figure 1-1



☐1-5. _____

☐1-6. _____

_____

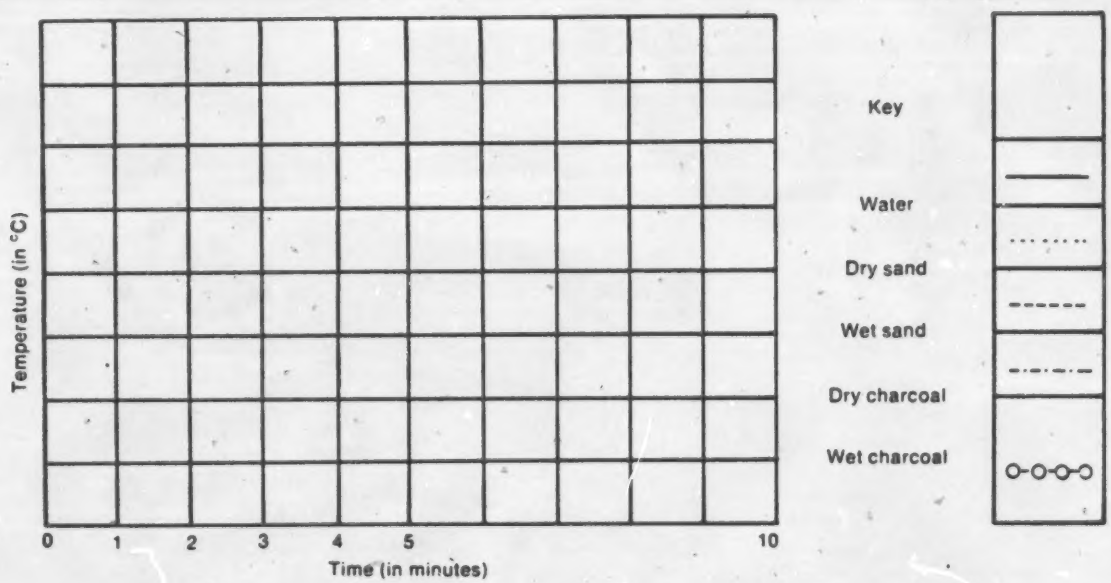
☐1-7. _____

☐1-8. _____

Table 1-1

Material	Light Off at Beginning of Experiment	Light Turned On			Light Off After 5 Minutes Cooling
		After 1 Minute	After 3 Minutes	After 5 Minutes	
	THERMOMETER READING (°C)				
Water					
Dry sand					
Wet sand					
Dry charcoal					
Wet charcoal					

FIGURE 1-4



☐1-9. _____

☐1-10. _____

☐1-11. _____

☐1-12. _____

☐1-13. _____

PROBLEM BREAK 1-1

Does air over different surfaces get hotter?
Plan:

Data:

Conclusions:

☐1-14. _____

☐1-15. _____

_____

_____

_____

_____

Chapter 2
Weather Watch

Table 2-1

1st Week	Weather-Watch Chart				
1. Date					
2. Time of day					
3. Temperature (°C)					
4. Wind direction					
5. Wind speed (mph)					
6. Cloud type					
7. Cloud cover					
8. Precipitation (in inches)					
9. Barometric pressure (in inches)					
10. Relative humidity					
11. Dew point (°C)					

Table 2-1

2nd Week	Weather-Watch Chart				
1. Date					
2. Time of day					
3. Temperature (°C)					
4. Wind direction					
5. Wind speed (mph)					
6. Cloud type					
7. Cloud cover					
8. Precipitation (in inches)					
9. Barometric pressure (in inches)					
10. Relative humidity					
11. Dew point (°C)					

Table 2-1

3rd Week	Weather-Watch Chart				
1. Date					
2. Time of day					
3. Temperature (°C)					
4. Wind direction					
5. Wind speed (mph)					
6. Cloud type					
7. Cloud cover					
8. Precipitation (in inches)					
9. Barometric pressure (in inches)					
10. Relative humidity					
11. Dew point (°C)					

Table 2-1

4th Week	Weather-Watch Chart				
1. Date					
2. Time of day					
3. Temperature (°C)					
4. Wind direction					
5. Wind speed (mph)					
6. Cloud type					
7. Cloud cover					
8. Precipitation (in inches)					
9. Barometric pressure (in inches)					
10. Relative humidity					
11. Dew point (°C)					

Chapter 3 Concentrating on Ups

☐3-1. _____

☐3-2. _____

☐3-3. _____

☐3-4. _____

PROBLEM BREAK 3-1

How does air temperature vary with altitude?
Plan:

Data:

Conclusions:

☐3-5. _____

☐3-6. _____

☐3-7. _____

_____

_____

☐3-8. _____

☐3-9. _____

☐3-10. _____

☐3-11. _____

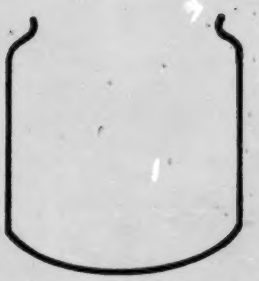


FIGURE 3-7

☐3-12. _____

_____

_____

☐3-13. _____

☐3-14. _____

☐3-15. _____

☐3-16. _____

PROBLEM BREAK 3-2

Effect of decreasing jar temperature on the pointer
Plan:

Data:

Conclusions:

☐3-17. _____

☐3-18. _____

☐3-19. _____

_____

_____

PROBLEM BREAK 3-3

Calibrating the jar barometer

Chapter 4 Making Visible the Invisible

☐4-1. _____

☐4-2. _____

☐4-3. _____

_____

_____

☐4-4. _____

☐4-5. _____

Table 4-1

Trial	Room Temp. (°C)	Temperature When Film of Moisture Forms (°C)
1		
2		
3		
Average		

☐4-6. _____

☐4-7. _____

☐4-8. _____

☐4-9. _____

_____

☐4-10. _____

☐4-11. _____

☐4-12. _____

☐4-13. _____

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☐4-14. _____

☐4-15. _____

☐4-16. _____

_____

☐4-17. _____

_____

_____

_____

_____

☐4-18. _____

_____

☐4-19. _____

Table 4-4

	Observations
1. Jar 1, with cold water	
2. Jar 2, with hot water	
3. Jar 2, with hot water and smoke	

☐4-20. _____

☐4-21. _____

Chapter 5 More Reasons for Clouds

☐5-1. _____

☐5-2. _____

☐5-3. _____

☐5-4. _____

☐5-5. _____

☐5-6. _____

☐5-7. _____

PROBLEM BREAK 5-1

What are the effects of changing air pressure and temperature at the same time?
Plan:

Teacher approval

_____

Data:

Conclusions:

☐5-8. _____

_____

_____

☐5-9. _____

☐5-10. _____

☐5-11. _____

_____

☐5-12. _____

_____

☐5-13. _____

☐5-14. _____

PROBLEM BREAK 5-2

What is the direction of the wind during the day and during the night around a large body of water?

FIGURE 5-8

☐5-15. _____

_____

_____

_____

_____

Chapter 6 Other Cloud Formers

☐6-1. _____

_____

_____

_____

_____

☐6-2. _____

_____

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☐6-3. _____

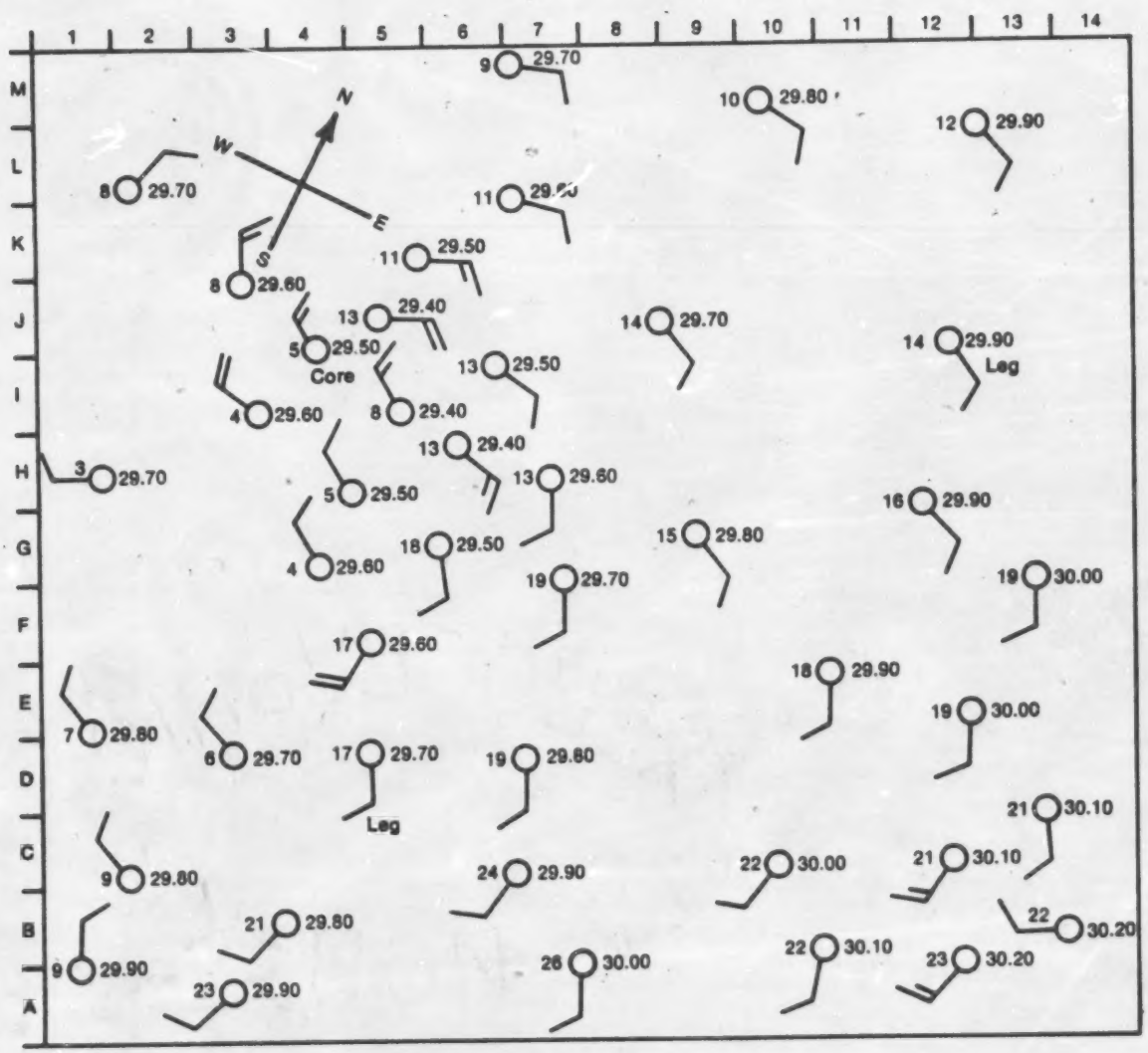
☐6-4. _____

☐6-5. _____

_____

☐6-6. _____

FIGURE 6-4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8 29.60
13 29.40
5 29.50
Core
13 29.50
14 29.70
14 29.90
Leg
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8 29.40
13 29.40
3 29.70
5 29.50
13 29.60
16 29.90
4 29.60
18 29.50
15 29.80
19 29.70
19 30.00
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☐6-7. _____

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☐ **6-8.** _____

☐ **6-9.** _____

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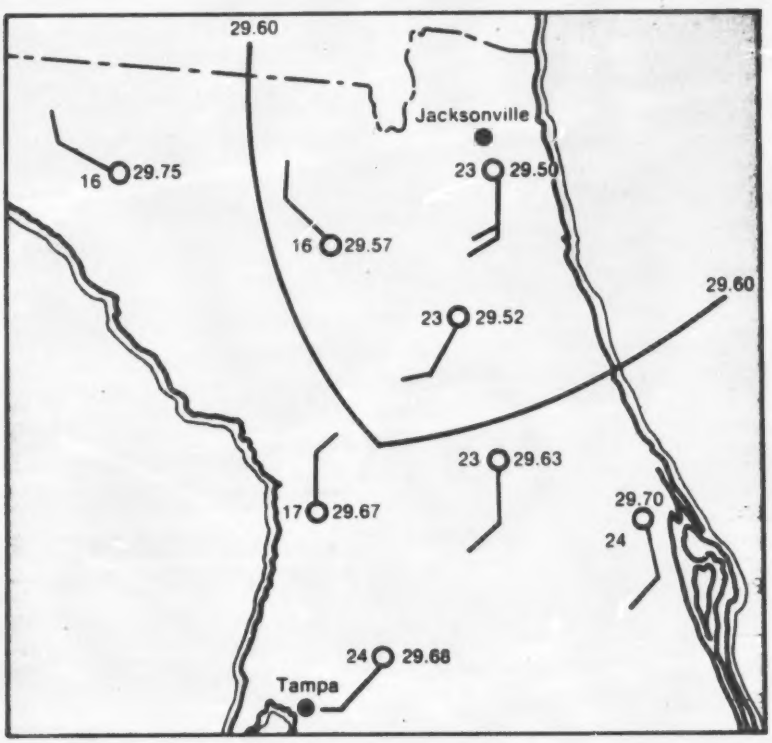
☐ **6-13.** _____

PROBLEM BREAK 6-1

FIGURE 6-9



☐6-14. _____

_____

☐6-15. _____

PROBLEM BREAK 6-2

Chapter 7
Moving Weather

☐7-1. _____

☐7-2. _____

☐7-3. _____

☐7-4. _____

☐7-5. _____

☐7-6. _____

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☐7-11. _____

_____

☐7-12. _____

_____

_____

☐7-13. _____

☐7-14. _____

☐7-15. _____

☐7-16. _____

☐7-17. _____

_____

☐7-18. _____

☐7-19. _____

☐7-20. _____

☐7-21. _____

Table 7-1

	COLD FRONT		
	Immediately Ahead of the Front	Along the Front	Immediately Behind the Front
Barometric reading			
Temperature			
Cloudiness			
Wind direction			

Table 7-2

	WARM FRONT		
	Ahead of the Front	Along the Front	Behind the Front
Barometric reading			
Temperature			
Cloudiness			
Wind direction			

PROBLEM BREAK 7-1

How are two weather variables related?
Plan:

Tally Table:

Percentage (Probability):

Conclusions:

☐7-22. _____

_____

_____

_____

Excursions

Excursion 1-1
Hot Air Balloon

☐1. _____

_____

☐2. _____

Excursion 2-2
Billboards of the Sky

☐1. _____

☐2. _____

Excursion 2-3
The Conversion Excursion

☐1. _____

☐2. _____

☐3. _____

☐4. _____

☐5. _____

☐6. _____

☐7. _____

☐8. _____

Excursion 3-1 The Pressure's On

CHECKUP:

1. **a.** 7 pounds (____)
   b. 9 newtons (____)
   c. 6 pounds per square inch (____)
   d. 4 square inches (____)
   e. 8 newtons per square meter (____)

2. A 500-pound metal bar is lying on a bench. The area of the bottom of the bar is 50 square inches. What is the pressure of the bar on the bench? (_____)

☐1. _____

_____

☐2. _____

Excursion 3-2 Measuring Air Pressure . . . in Inches?

☐1. _____

☐2. _____

☐3. _____

☐4. _____

☐5. _____

Excursion 4-1 The Shivering Thermometer

☐1. _____

Table 1	Temperature (°C)
Temperature A	
Temperature B	
Temperature C	

☐2. _____

_____

☐3. _____

☐4. _____

_____

☐5. _____

☐6. _____

☐7. _____

☐8. _____

_____

☐9. _____

Table 2

Condition	Temperature (°C)			
	After 15 sec.	After 30 sec.	After 45 sec.	After 60 sec.
1. Thermometer (on table)				
2. Thermometer (waved around)				

☐10. _____

_____

_____

_____

_____

_____

_____

☐11. _____

☐12. _____

Excursion 5-1 How High Are the Clouds?

☐1. _____

_____

☐2. _____

☐3. _____

_____

☐4. _____

☐5. _____

☐6. _____

☐7.

☐8. Height of clouds today:
Data:

Method:

Conclusions:

☐9. _____

_____

Excursion 5-2
Building a Nephoscope

Table 1

Distance moved by reflection (d)	0.05 meter
Time to move 5 cm (t)	seconds
Height of eye above nephoscope (h)	meters
Estimated height of clouds (H) (See **Excursion 5-1**)	meters

☐1. _____

☐2. _____

☐3. _____

☐4. _____

_____

☐5. _____

_____

_____

Excursion 7-1
And the Rains Came Down

☐1. _____

☐2. _____

☐3. _____

_____

_____

_____

☐4. _____

_____

Excursion 7-2
Cumulonimbus

☐1. _____

_____

_____

☐2. _____

_____

_____

_____

☐3. _____

☐4. _____

☐5. _____

_____

_____

☐6. _____

_____

_____

☐1. _____

☐2.

Excursion 7-3
Weather Prediction and Forecasting

Table 1

Data	Time	Temp.	Wind Dir.	Wind Speed	Cloud Type	Cloud Cover	Pre-cip.	Bar. Pres.	Rel. Hum.	Dew Point
20	1:30	17°C	S	8–12	Stratus	◯	—	29.90	55%	13°C
21	2:05	20°C	S	8–12	Stratus	◯	—	29.88	83%	18°C
22	1:50	10°C	N	25–31	Cumulo-nimbus	◯	1.5 cm	29.81	100%	10°C
23	1:45	5°C	N	8–12	Clear	◯	—	29.92	29%	−9°C
24	—	—	—	—		—	—	—	—	—

Activity 1. Three-day forecast of weather
1st day forecast:

2nd day forecast:

3rd day forecast:

	1st day	2nd day	3rd day
1. Cloudiness			
2. Probable wind direction			
3. Probable wind speed			
4. Barometer change			
5. Probable cloud types			
6. Probable temperature range			
7. Precipitation (amount and type)			

Activity 2. (Optional) Extended forecast.
Temperature:

Precipitation:

Movements of fronts through area:

How Well Am I Doing?

You probably wonder what you are expected to learn in this science course. You would like to know how well you are doing. This section of the book will help you find out. It contains a Self-Evaluation for each chapter. If you can answer all the questions, you're doing very well.

The Self-Evaluations are for your benefit. Your teacher will not use the results to give you a grade. Instead, you will grade yourself, since you are able to check your own answers as you go along.

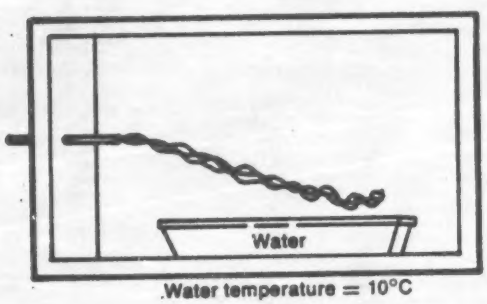
Here's how to use the Self-Evaluations. When you finish a chapter, take the Self-Evaluation for that chapter. After answering the questions, turn to the Answer Key that is at the end of this section. The Answer Key will tell you whether your answers were right or wrong.

Some questions can be answered in more than one way. Your answers to these questions may not quite agree with those in the Answer Key. If you miss a question, review the material upon which it was based before going on to the next chapter. Page references are frequently included in the Answer Key to help you review.

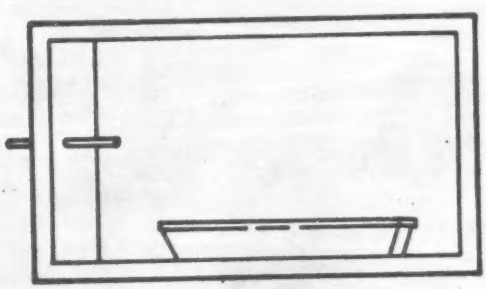
On the next to last page of this booklet, there is a grid, which you can use to keep a record of your own progress.

If you did any excursions for this chapter, write their numbers here. SELF EVALUATION 1

☐**1-1.** The diagram below shows a sketch that an ISCS student made after using the observation box.



A. Sketch the path of the smoke in the box below if the air temperature were 5°C and the water temperature were 15°C.



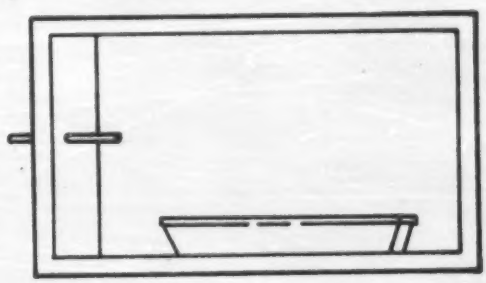
B. Explain your answer to part **A.**

_____

_____

_____

C. Sketch the path of the smoke in the box below if the air temperature were 15°C and the water temperature were 15°C.



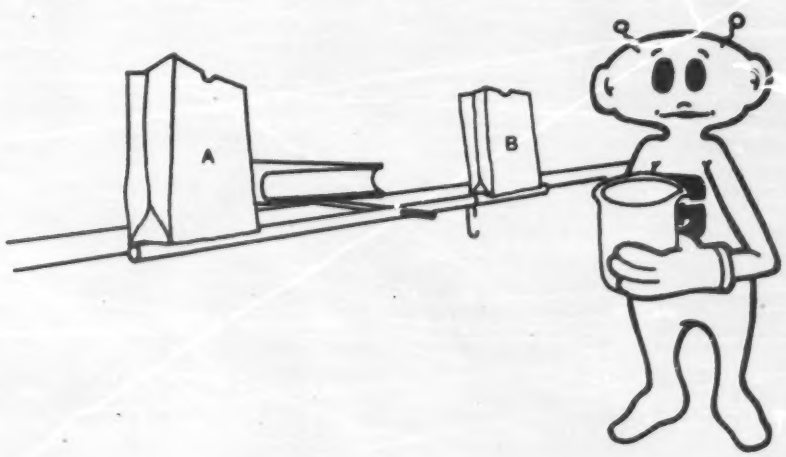
D. Explain your answer to part **C.**

_____

_____

_____

☐**1-2.** Iggy has set up the balance that you used in Activities 1-6 and 1-7. However, he has turned the bags right side up this time.



Iggy has a beaker that has been sitting in the freezer for several hours.

A. What will happen if Iggy inverts the beaker just above bag B?

_____

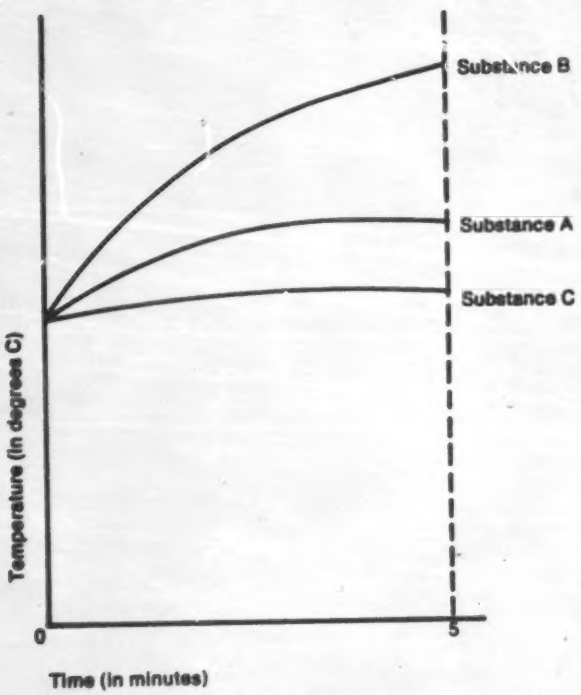
B. Explain your answer to part **A** in terms of the particle model.

_____

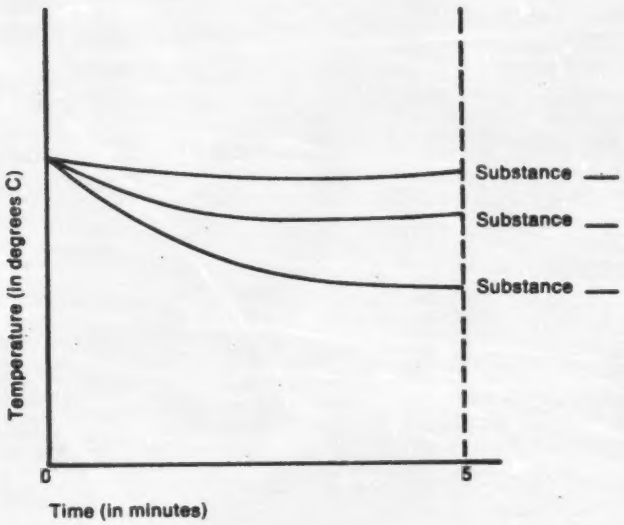
_____

_____

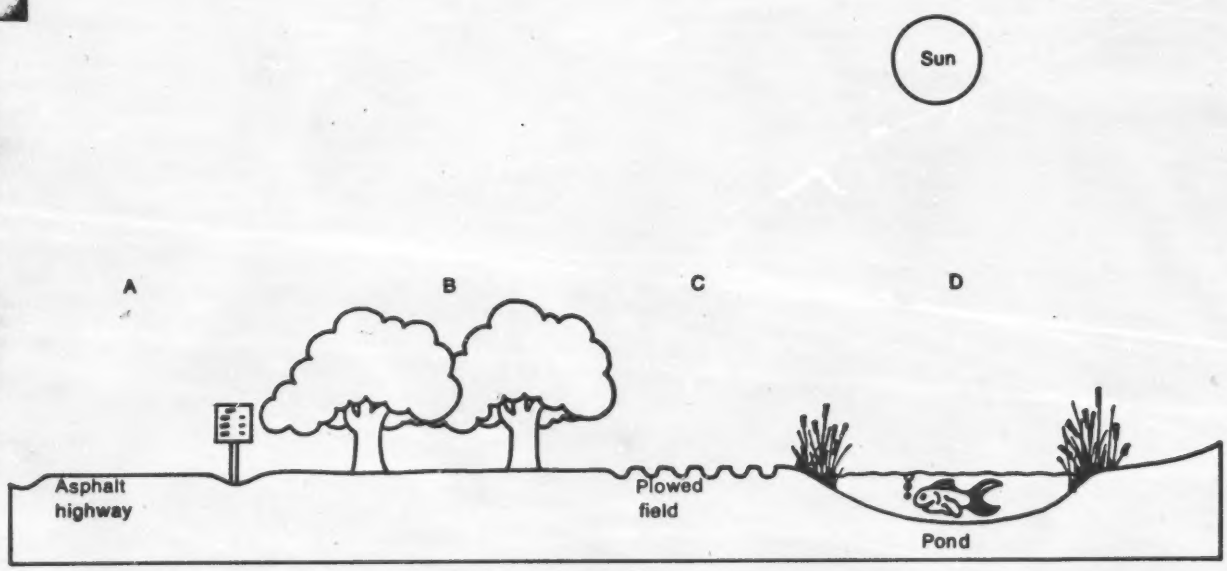
☐**1-3.** Three substances, A, B, and C, were warmed by a lamp in the same way that you warmed up dry sand, dry charcoal, wet sand, wet charcoal, and water. Their warming curves are shown below.



Later these three substances were put in a refrigerator and their temperatures recorded after five minutes. Indicate which of the lines corresponds to each of the substances by filling in the blank beside each curve.



☐**1-4.** Refer to the sketch below to answer parts **A**, **B**, **C**, and **D** that follow.



A. On a warm sunny day, in which of the areas (A through D) would you expect the air to be rising?

_____

B. Explain your answer to part **A.**

_____

_____

_____

C. On a warm sunny day in which of the areas (A through D) would you expect the air to be moving downward?

_____

D. Explain your answer to part **C.**

_____

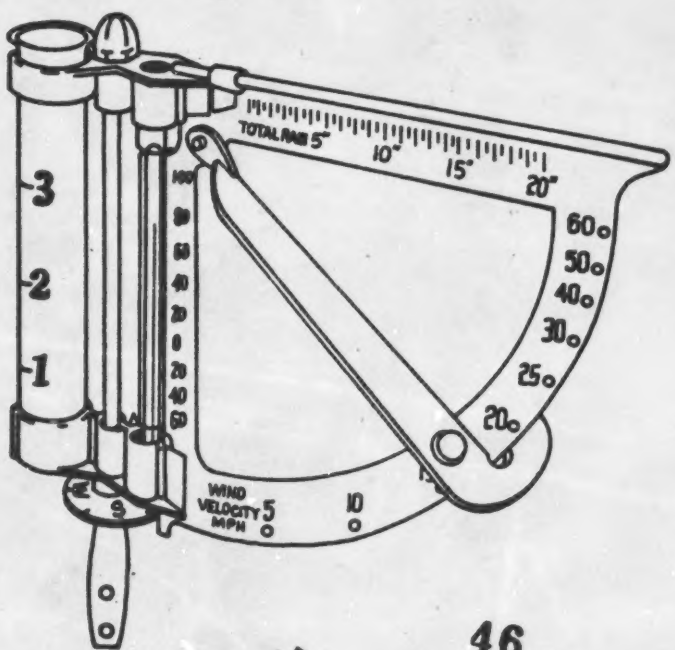
_____

_____

If you did any excursions for this chapter, write their numbers here. SELF EVALUATION 2

_____

☐**2-1** Use the diagram below to answer the questions that follow. (Remember that speed in km/hr = 1.6 × mi/hr.)



A. What is the direction of the wind as indicated by the weather station?

_____

B. What is the speed of the wind (in mph) as indicated by the weather station?

_____

C. What is the speed of the wind (in km/hr) as indicated by the weather station?

_____

☐**2-2.** Use the photographs below to answer the questions that follow.

Photo 1

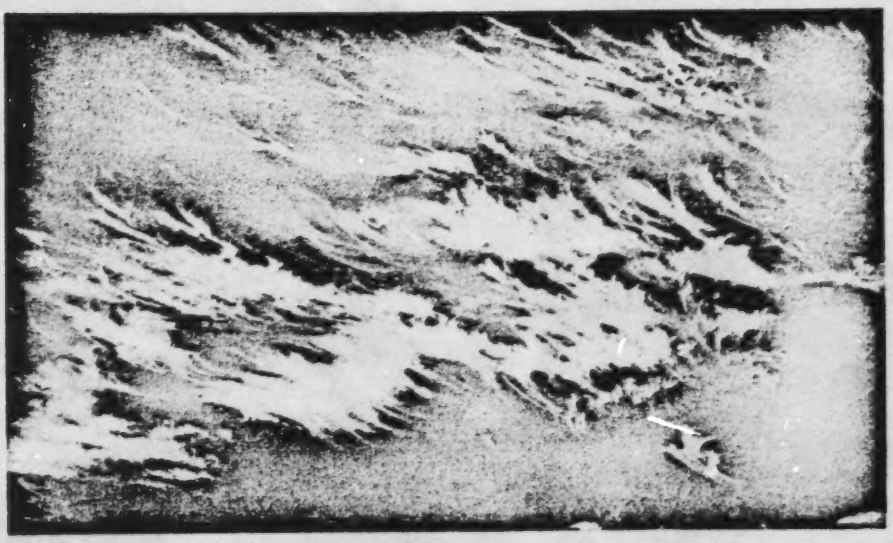


Photo 2

A. What type of cloud is shown in photo 1?

_____

B. What type of cloud is shown in photo 2?

_____

C. Draw the symbol to represent how much of the sky is covered by clouds in Photo 1.

_____

D. Draw the symbol to represent how much of the sky is covered by clouds in photo 2.

_____

☐**2-3.** If 1.5 inches of rain fell overnight, how many centimeters of rain should you record in your Weather Watch Chart? (Remember: 1 inch = 2.54 cm.)

_____

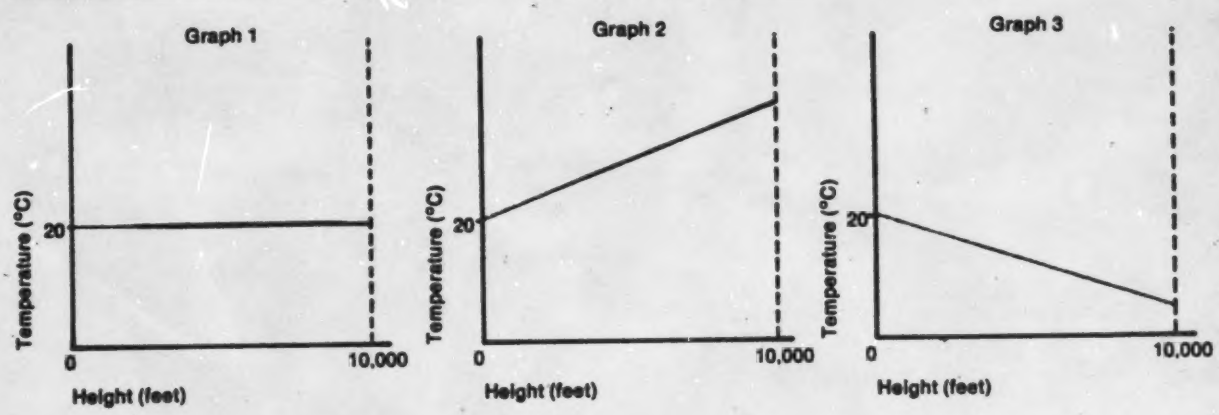
If you did any excursions for this chapter, write their numbers here.

_____

SELF EVALUATION 3

☐**3-1. A.** If you were riding in a small plane and plotted a graph of the temperature outside the plane at different altitudes, which of the following graphs would you expect to look most like yours?

_____

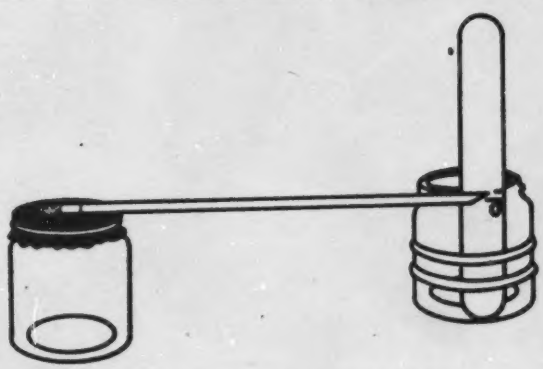


B. Explain your answer to part **A.**

☐**3-2** **A.** Suppose you were a deep-sea diver. As you dive deeper and deeper into the ocean would you expect the pressure to increase, decrease, or remain the same?

B. Explain your answer to part **A.**

☐**3-3.** **A.** An ISCS student built an atmospheric pressure measurer several days ago. Today the pressure measurer looks like the one shown below. Has the air pressure in the room increased, decreased, or stayed the same since he built the pressure measurer?



B. Explain your answer to part **A.**

☐**3-4. A.** On a cool summer morning your family starts on a trip in the car. After driving for several hours over the hot asphalt highway, you stop for lunch. Suppose you had measured the pressure of the air in the car's tires in the morning and again when you stopped for lunch. Would the pressure have increased, decreased, or remained the same?

_____

B. Explain your answer to part **A.**

_____

_____

_____

☐**3-5.** The air pressure at the top of a tall building is 29.4 inches of mercury. What will be the air pressure at street level at that time? (Check the best answer)

____**a.** Greater than 29.4 inches of mercury

____**b.** 29.4 inches of mercury

____**c.** Less than 29.4 inches of mercury

If you did any excursions for this chapter, write their numbers here. **SELF EVALUATION 4**

_____

☐**4-1.** In areas with cold winters, windows are sometimes covered with a layer of frost on the inside. Explain why the frost forms on the windows.

_____

_____

_____

☐**4-2.** Suppose that a 1,000-milliliter sample of air could contain 32 milligrams of water. The 1,000-milliliter sample of air actually contains only 18 milligrams of water. What is the relative humidity of this sample of air?

_____

☐**4-3.** Get a sling psychrometer from the supply area. Use it to measure the relative humidity in your classroom. (You may refer to tables in the chapter if you need to.)

Relative humidity = _____

☐**4-4.** An ICSC student was measuring the relative humidity in his classroom and obtained the following readings.

Dry-Bulb Temperature = 18°C
Wet-Bulb Temperature = 12°C

You may use any tables in the text to answer the following questions.
A. What is the relative humidity in the room?

_____

B. What is the dew point?

_____

☐**4-5.** What is the relative humidity of air that is at its dew-point temperature?

_____

☐**4-6.** Suppose there were a section of the country where the air was moist but there were very few solid particles in the air. Predict what would happen if a new electricity generating plant that gave off a lot of smoke were built in this area.

_____

_____

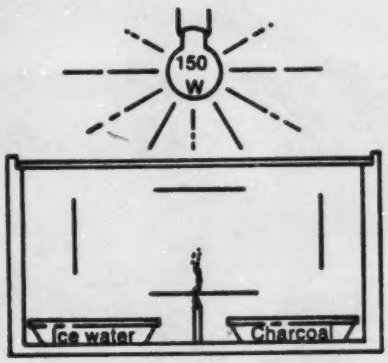
_____

_____

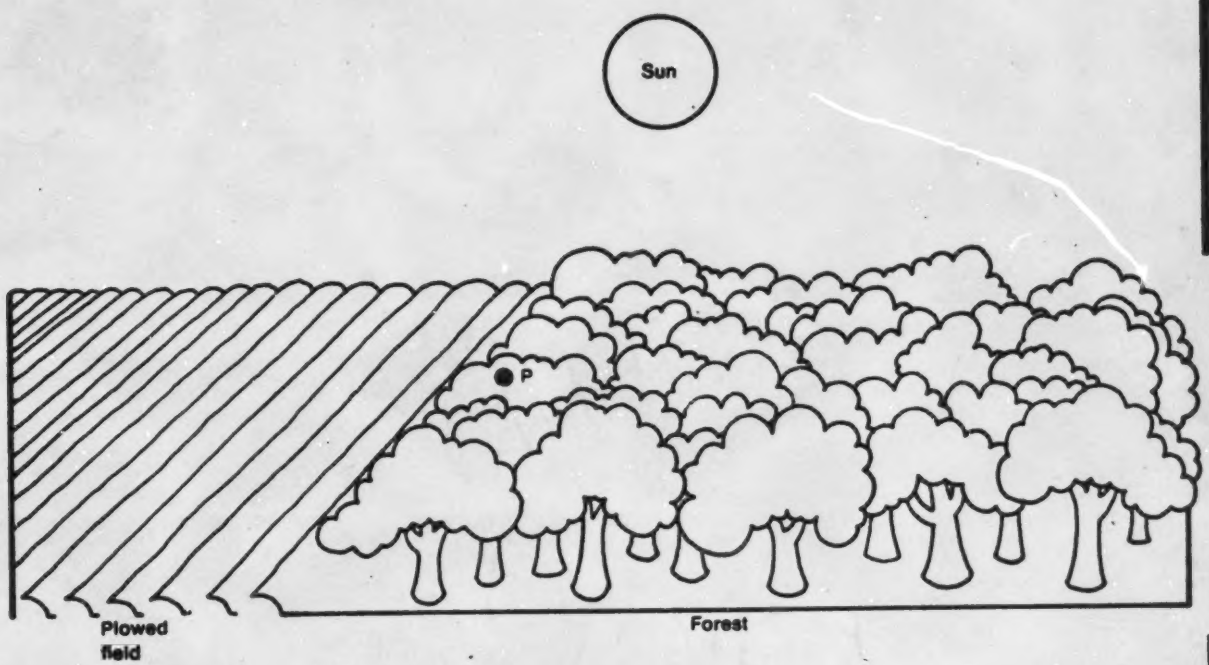
SELF EVALUATION 5 If you did any excursions for this chapter, write their numbers here.

_____

☐**5-1.** The diagram on the next page shows an observation box with a glass top. Show the direction of motion of the smoke particles in the box when the light is on by drawing arrowheads on the lines.



☐**5-2.** Use the diagram below to answer the questions that follow. There is no prevailing wind.



A. Draw an arrow on the diagram to indicate the direction that the wind would be blowing at point P.
B. By shading in on the diagram, indicate where you might expect clouds to form.

C. Draw an arrow pointing downward on the diagram to indicate where the air may be moving down.

☐**5-3.** Many types of high-altitude balloons are made out of thin plastic so that they can expand or contract easily.
A. Which sketch do you think best represents what you would see as you watched a balloon rise?

Sketch 1 Sketch 2 Sketch 3

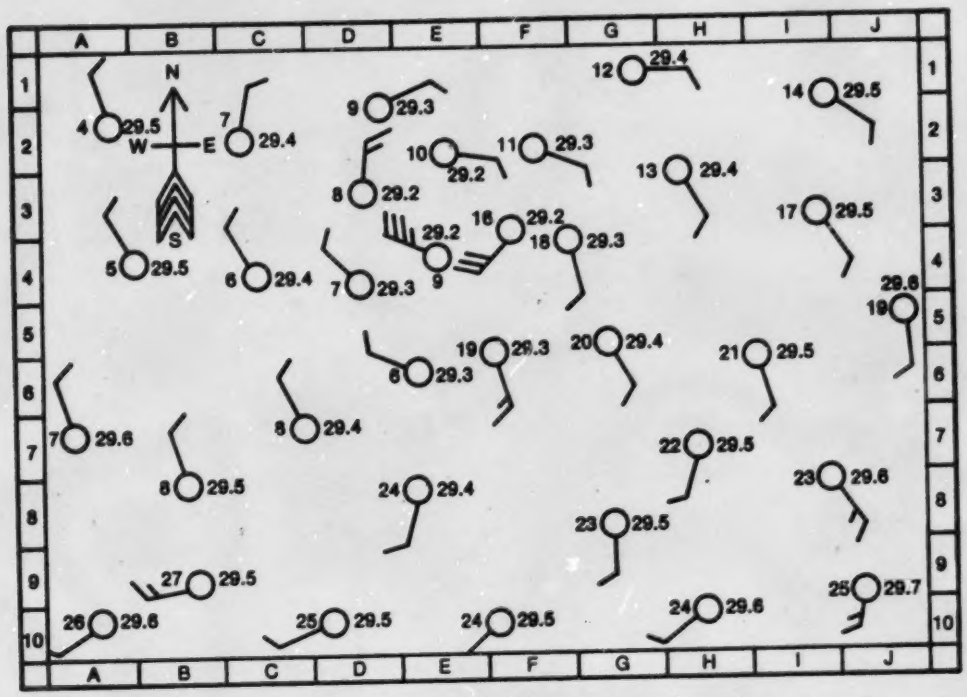
B. Explain your answer to part **A.**

☐**5-4.** In the winter, snow may lie on the ground for months at a time. As long as it stays cold, and the snow is in an undisturbed place, the snow remains very white. When it starts to melt, it begins to look dirty. Explain why this occurs.

If you did any excursions for this chapter, write their numbers here.

_____

☐**6-1.** Use the map below to answer the questions that follow.



A. Using the border symbols and a straightedge, describe the following locations by letter and number.

a. ____Highest wind velocity **c.** ____Highest barometric pressure

b. ____Lowest temperature **d.** ____Highest temperature

B. Draw in the isobars (lines of equal pressure).
C. Shade in the areas that you would expect to have heavy cloud cover.
D. Explain why you shaded the areas you did for part **C**.

_____

_____

_____

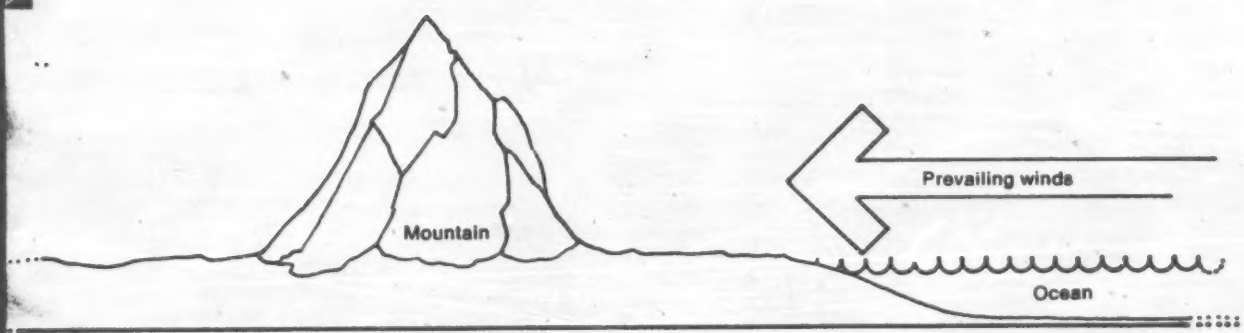
E. Is the region E3 a high- or a low-pressure area?

_____

☐**6-2.** What is the direction of air motion around a low-pressure area?

_____

☐**6-3.** Use the diagram below to answer the questions that follow.



A. Shade in the area on the diagram where you would expect the clouds to form.
B. Label the area on the diagram that receives the most rainfall as WET.
C. Label the area on the diagram that receives the least rainfall as DRY.

☐**6-4.** What are four things to look for on a weather map when predicting where clouds will form?

a. _____

b. _____

c. _____

d. _____

SELF EVALUATION 7 If you did any excursions for this chapter, write their numbers here.

_____

☐**7-1.** Large weather disturbances move slowly across the North American continent. What is the general direction of motion?

_____

☐**7-2.** Suppose a low-pressure area is approaching the part of the country where you live.

A. What changes would you expect in the amount of cloud cover as it approaches?

_____

B. What changes would you expect in the barometric pressure reading?

_____

C. What changes in the wind direction would you expect as the system passes?

_____

☐**7-3.** Label the three front symbols shown below with their correct names (cold, warm, or stationary).

a. _____ b. _____ c. _____

☐**7-4.** The weather forecast for today reads: sunny and hot today with the chance of local thunderstorms in the late afternoon or early evening. Explain what causes these local storms.

_____

_____

_____

☐**7-5.** Yesterday an ISCS student noticed some cirrus clouds in the sky. Today he noticed that the barometer had fallen slightly, the wind had shifted so that it was blowing from the southeast, and there was a heavy layer of cumulus clouds overhead.

A. Predict whether the temperature will increase, decrease, or remain the same over the next day or so.

_____

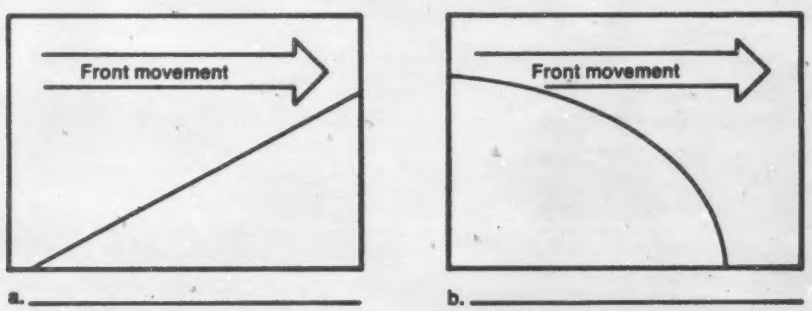
B. Predict whether the rain that is coming will last for just a few hours or for at least a day.

_____

C. What will be the approximate wind direction once the rain has passed?

_____

☐**7-6.** Generally there is a difference in the shape of fronts. Label the fronts shown as warm or cold.



a. _____ b. _____

☐**7-7.** On the basis of your last few days weather watch, predict what tomorrow's weather will be like.

_____

_____

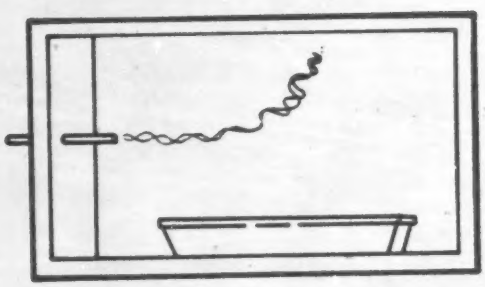
_____

_____

SELF-EVALUATION ANSWER KEY

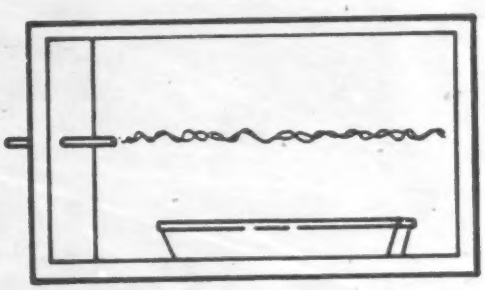
SELF EVALUATION 1

1-1. A.



B. Your answer should indicate that the smoke will rise because of the fact that the water is warmer than the surrounding air. This causes an updraft above the water surface. If you had difficulty with this, you should try Activities 1-2 to 1-5 again.

C.

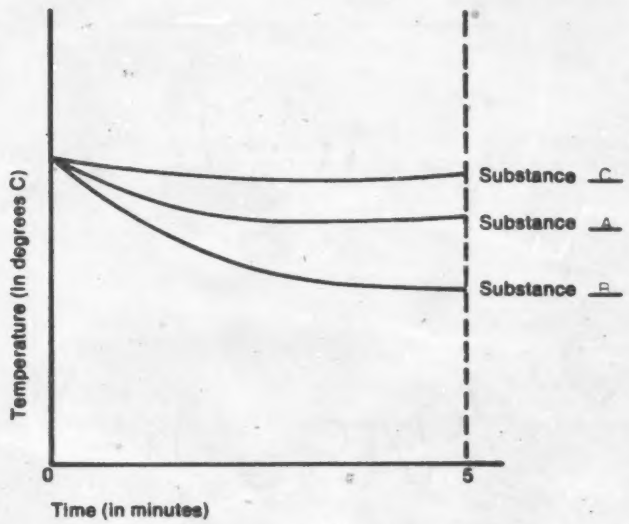


D. Your answer should have indicated that since the water and the air are at the same temperature, there will not be an updraft or a downdraft. The smoke will then travel straight across the box. You may want to try this for yourself.

1-2. A. The balance will tip so that bag B is lower than bag A.

B. The particles of air in the cold beaker are moving slower than the particles of air in the room. The particles are then closer together. When this cold air is poured into bag B, there will be more air particles in B than in A. Since each particle has weight, the weight of particles in bag B is greater than the weight of those in bag A. This means that the balance will tip down on the side that has bag B. If you had difficulty answering this question, you should reread pages 5 and 6. You might want to use this as part of a magic show at home.

1-3. You should have labeled the graph as shown below.



While doing Activities 1-8 to 1-11, you should have noticed that those substances that warm up most rapidly also cool down rapidly. Check your graph (Figure 1-4) in your Record Book if you forgot about this.

1-4. A. Areas A and C

B. You should have indicated that the highway and the plowed field warm up rapidly in the sun. Since the surface is warm, the air above it is heated. This warm air tends to rise.

C. Areas B and D

D. The forest and the pond will not warm up as rapidly on a sunny day. As a result, the air above them is cooler and tends to move downward.

If you had trouble with these questions, look over your observations from the observation box activities and pages 11 to 13 again.

SELF EVALUATION 2

2-1. A. There is a southeast wind blowing. Remember that the wind direction is the direction *from* which the wind is blowing.

B. The wind speed is about 18 or 19 mph.

C. The wind speed is about 29 km/hr. If you had difficulty with this, you should work through Excursion 2-3 again.

2-2. A. These clouds are cirrus clouds. Note their thin, wispy appearance.

B. These are cumulus clouds. Note their tall, billowy shapes and flat bottoms. If you had difficulty in identifying either of these cloud shapes, you should take another look at page 18 and work through Excursion 2-2.

C. The sky is about 25% overcast, so the symbol is ◔.

D. Here the sky is about 50% overcast, so the symbol is ◑.

2-3. About 3.8 centimeters of rain fell. If you had difficulty with this question, you should take another look at Excursion 2-3.

SELF EVALUATION 3

3-1. A. Graph 3

B. As you get farther from the earth's surface, the air usually becomes cooler (about 2°C/1,000 ft). Sometimes, under unusual circumstances, the temperature stays constant or even rises as you go higher. This unusual distribution of air is called a thermal inversion. During an inversion, smoke and exhaust fumes do not rise and mix with the rest of the air but stay near the ground. This can cause very severe smog that may endanger the lives of people who have respiratory diseases such as pneumonia or asthma.

3-2. A. The pressure will increase.

B. The pressure is the weight of substance above an object. The greater the depth in the ocean, the greater the weight of the material in the column above an object. Thus, the pressure increases. If you had difficulty answering this question, read pages 24 and 25 again and work through Excursion 3-1.

3-3. A. The pressure has increased.

B. The rubber diaphram has been pushed inward. This indicates that the air outside has pushed it in and compressed the air inside. If you had problems with this question, reread pages 26 and 27.

3-4. A. The pressure will have increased.

B. While driving, the tires get very hot and this increases the pressure inside. This is similar to what you did in Activity 3-9 when you warmed up your barometer. In case you actually try measuring the pressure in the car tires, here is a safety tip. Do not let air out of the tires to reduce the pressure to what it was in the morning. If you do, the increased flexing of the tire may heat it enough so that it will catch fire or blow out, causing a serious accident. For tire safety, check the air pressure when the tires cool and keep the pressure up to what the manufacturer recommends.

3-5. The answer is **a**. It will be greater, since the weight of air above the barometer will be greater. If you want to try this yourself, you need a fairly tall building. The pressure should change about 0.10 inch of mercury for every 7 to 10 stories change in height.

SELF EVALUATION 4

4-1. Your answer should have included these ideas: The window glass is cold and this cools down the inside air near the window below the dew point. Moisture then condenses on the inside of the window. If the glass is cold enough, the moisture will freeze and produce frost on the inside of the window. If you did not include these ideas in your answer you should reread pages 37 to 40.

4-2. The relative humidity would be about 56%. If you did not get this answer, you should reread page 41.

4-3. Check your answer with two or three other students who are at the same place in the book. If your answer does not agree with theirs or if you forgot how to find the relative humidity, read page 43 and try again.

4-4. A. The relative humidity is about 49%. Reread page 43 if you did not get this answer.

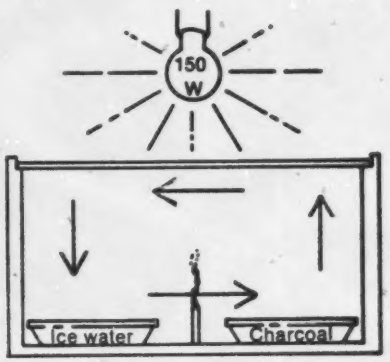
B. The dew point is 13°C. You should study pages 45 and 46 again and do Excursion 4-1 if you had difficulty with this question.

4-5. The relative humidity at the dew point is 100%. If you had difficulty answering this question, reread pages 40 and 41.

4-6. As you know, you need both solid particles and rising moist air to produce clouds. If one of the two is missing, you will produce few clouds. If the new plant gives off a lot of solid particles, it may cause a great deal more cloud formation and upset the local climate patterns. Check pages 48 and 49 if you missed this.

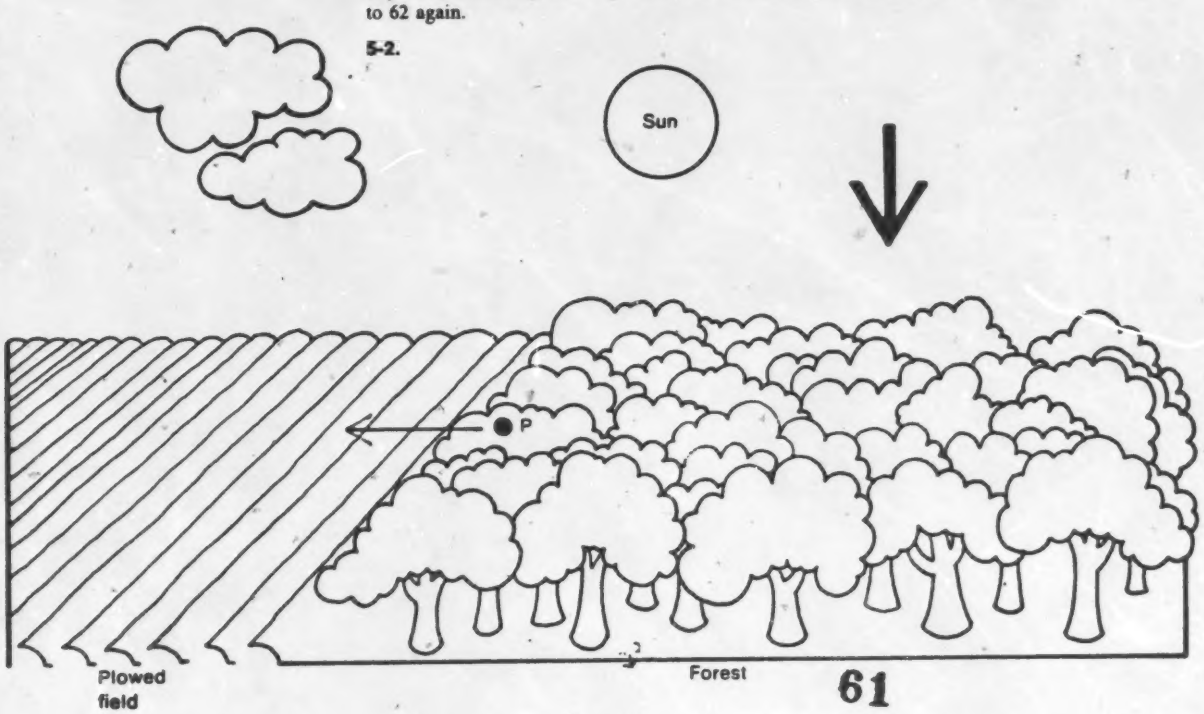
SELF EVALUATION 5

5-1.



If you had difficulty deciding about the directions, you should look over pages 8 to 11 and 59 to 62 again.

5-2.



A. The wind is from the cooler forest toward the warmer plowed field, as shown on page 50.
B. The warm air over the plowed field will rise. You would expect this rising warm air to form clouds over the warmer surface, as indicated above.
C. The air above the forest will be cooler, so it will tend to be moving downward. Look at pages 61 through 63 again if you missed any of these questions.

5-3. A. You would expect the balloon to appear as in sketch 2.

B. As you go higher above the earth's surface, the pressure will decrease. This means that the balloon will swell outward much as the top of your atmospheric pressure measurer did when the air pressure decreased.

5-4. This question is a bit tricky, so you may have had to think about it for a while. You know that solid particles are necessary for clouds to form. These particles are trapped inside the snowflakes or raindrops that fall. When the snow begins to melt, the water runs away or evaporates, leaving these particles on the surface of the snow. This layer of fine particles gives melting snow its gray appearance. If you live where snow falls, you may want to try melting some snow and looking at these tiny particles. Of course, some of the particles may have settled out of the air onto the snow surface. See page 54.

SELF EVALUATION 6

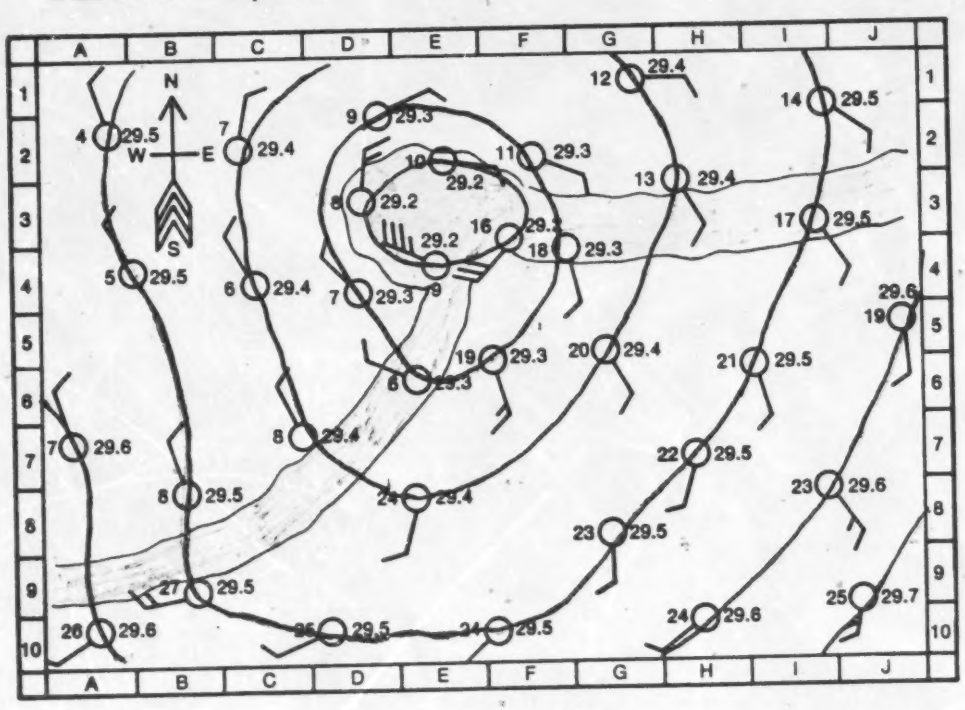
6-1. A. a. E-4

b. A-2

c. J-10

d. B-9

B and **C.** —see the map below.

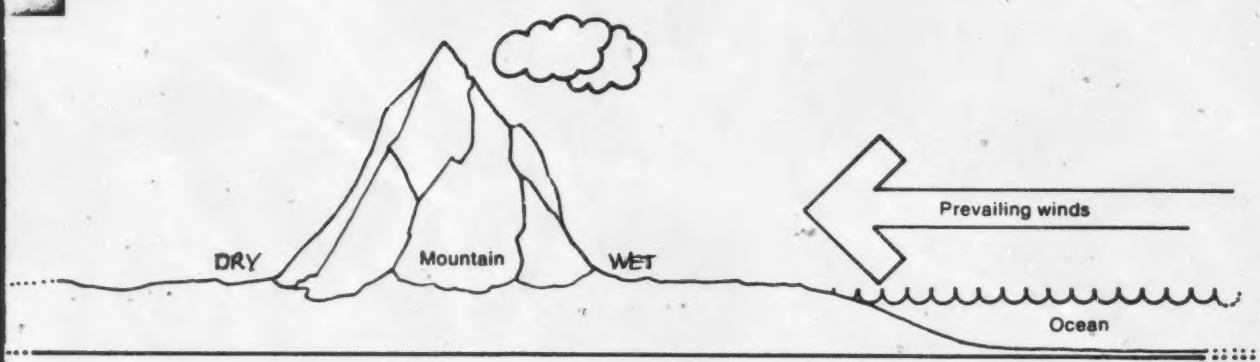


D. The cloud is due to two different factors. The cloudbank around E3 is due to the low-pressure area there. The long banks of clouds from E3 to A9 and from E3 to J2 are due to lines of sharp temperature difference (fronts). If you had trouble deciding where and why the clouds will form, reread pages 65 to 75.

E. The region is a low-pressure area. You can tell this from the barometer readings at various weather stations in this area.

6-2. North of the equator, the air moves around a low-pressure area counterclockwise. Reread pages 73 to 75 if you did not remember the direction. You may be interested to know that south of the equator the air moves clockwise around a low-pressure area. Check with your teacher for some other books on meteorology if you would like to find out more about this.

6-3.



A. The clouds will form where the moist air is pushed up over the mountain. The rising air cools and once it reaches the dew point, clouds will form.

B. The side of the mountains nearest the ocean will receive the most rainfall. Here is where the air is being cooled and the clouds form.

C. On the side of the mountains away from the oceans, it is usually very dry. The air becomes warmer as it comes down the side of the mountain. If the air warms up and the amount of moisture it contains stays the same, its relative humidity decreases. See pages 77 through 79 if you had trouble with these.

6-4. Some things to look for are these:

- **a.** Low-pressure areas
- **b.** Lines of sharp temperature difference
- **c.** Mountains
- **d.** Large bodies of water and their coastal areas
- **e.** Areas where there is uneven surface heating

SELF EVALUATION 7

7-1. The general direction of motion of air masses is easterly. If you did not remember this, take another look at the weather maps on pages 83 through 86.

7-2. A. As the low-pressure area approaches, the sky would cloud over.

B. The barometric pressure reading would decrease.

C. The wind would be generally from the south before the low-pressure area arrived. As it passes, the wind would shift rapidly so that it is coming from the north. If you had difficulty answering these questions, look closely at the weather in Syracuse, New York, as the low-pressure area approaches. See pages 83 through 86.

7-3. a. stationary front
b. cold front
c. warm front

7-4. Small local storms in the afternoon are usually caused by uneven heating of the earth's surface.

7-5. The type of clouds that he saw indicates that a warm front is approaching.
A. The warm front will bring warmer temperatures over the next few days.
B. The rain when it comes will last for at least a day. This is because a warm front has such a gradual slope. (See pages 89 through 93.)
C. As the front passes, the wind will most likely shift around so that it is blowing from the north or west. You can see this on the weather maps on pages 83 through 86. Pay particular attention to the warm front that passes through Fargo.

7-6. a. warm front
b. cold front
If you had difficulty recognizing the shape of the fronts, take another look at page 89.

7-7. Compare your prediction with that of other students and the official weather forecast for your area. The only way to check your answer is to wait until tomorrow. Good luck!

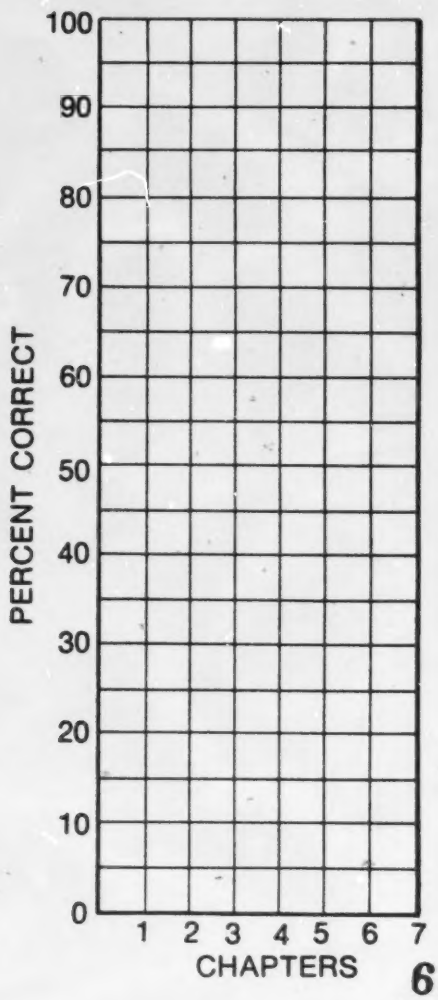
My Progress

Keep track of your progress in the course by plotting the percent correct for each Self Evaluation as you complete it.

$$\text{Percent correct} = \frac{\text{Number correct}}{\text{Number of questions}} \times 100$$

To find how you are doing, draw lines connecting these points. After you've tested yourself on all chapters, you may want to draw a best-fit line. But in the meantime, unless you always get the same percent correct, your graph will look like a series of mountain peaks.

RECORD OF MY PROGRESS



5 6 7 8 9 10 11 12 13 14 15-B 79 78 77 76 75 74

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36 United States Weather Bureau
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